

REMARKS

Applicants respectfully request reconsideration of the present application in view of the foregoing amendments and in view of the reasons that follow. Claims 15-22 have been allowed, and Claims 1-14 have been rejected. No claims have been amended, and no new matter has been added. Accordingly, Claims 1-22 remain pending in the present application.

This amendment adds, changes and/or deletes claims in this application. A detailed listing of all claims that are, or were, in the application, irrespective of whether the claim(s) remain under examination in the application, is presented, with an appropriate defined status identifier.

Claim Rejections – 35 U.S.C. § 103(a)

On page 2 of the Office Action, the Examiner maintained the previous rejection of Claims 1-14 as being obvious under 35 U.S.C. § 103(a) over U.S. Patent No. 6,068,951 (“Pierrat et al.”) or U.S. Patent No. 5,700,605 (“Ito et al.”) in view of U.S. Patent No. 5,549,995 (“Tanaka et al.”).

As noted by the Federal Circuit, the “factual inquiry whether to combine references must be thorough and searching.” McGinley v. Franklin Sports, Inc., 262 F.3d 1339, 60 USPQ.2d 1001 (Fed. Cir. 2001). Further, it “must be based on objective evidence of record.” In re Lee, 277 F.3d 1338, 61 USPQ.2d 1430 (Fed. Cir. 2002). The teaching or suggestion to make the claimed combination must be found in the prior art, and not in the applicant’s disclosure. In re Vaeck, 947 F.2d 488, 20 USPQ.2d 1438 (Fed. Cir. 1991). The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. In re Mills, 916 F.2d 680, 16 USPQ.2d 1430 (Fed. Cir. 1990). “It is improper, in determining whether a person of ordinary skill would have been led to this combination of references, simply to ‘[use] that which the inventor taught against its teacher.’” Lee (citing W.L. Gore v. Garlock, Inc., 721 F.2d 1540, 1553, 220 USPQ 303, 312-13 (Fed. Cir. 1983)).

The Examiner has not satisfied the burden of showing that there is a suggestion or motivation, either in the references themselves or in the knowledge generally available to one

of ordinary skill in the art, to modify the references or to combine the teachings of the cited references in the manner suggested (see, e.g., M.P.E.P. § 2143). For example, the Examiner stated (with emphasis added):

It would have been obvious to one having ordinary skill in the art to take the teachings of Pierrat et al. or Ito et al. and combine them with the teachings of Tanaka et al. in order to make the claimed invention because it is well known in the phase shifting mask art that the depth of trench can be adjusted to transmit light that is shifted by a desired amount.

However, such an alleged motivation does not provide a suggestion to modify the teachings of Pierrat et al. or Ito et al. in the manner suggested by the Examiner. For example, the Examiner has not shown that there is a suggestion that it would be desirable or even possible to provide a single phase-shifting mask that includes trenches of different depths, where the different depths are designed to allow shifting of different wavelengths of light. Instead, the motivation provided by the Examiner appears to be based only on the fact that “it is well known in the phase shifting mask art that the depth of trench can be adjusted to transmit light that is shifted by a desired amount.”

The Office Action also illustrates that the Examiner has engaged in improper hindsight reasoning by selecting features from otherwise unrelated references in an attempt to render the claimed invention obvious. For example, the Office Action states (with emphasis added):

The examiner maintains the rejection on the grounds that the prior art amply demonstrates all of the features of the claimed invention and there [sic] function in the mask art, that the prior art has shown the use of two different wavelengths of light together in one mask and that the use of a second trench for phase shifting a second wavelength of light is a repetition of the first trench for the same purpose.

Thus, the Examiner has not indicated that there is a suggestion to modify the cited references in the manner suggested. Instead, the Examiner has indicated that features of the claimed invention are “demonstrated” in the “mask art.” However, the claims must be reviewed as a whole. It is the combination of elements recited in the claims that must be taught or

suggested by the art. It is not sufficient to simply point out that various features are shown in various unrelated references. The only suggestion to make the combination recited in the rejected claims comes from the Applicants' own disclosure, and improper hindsight reasoning may not be used to render such a combination obvious.

The rejection of Claims 1-14 should be withdrawn, because there is no teaching or suggestion to combine the teachings of the cited references in the manner suggested by the Examiner.

Even if there were a proper motivation to combine the teachings of Pierrat et al. or Ito et al. with those of Tanaka et al. (which there is not), these references still would not teach or suggest the combination of elements recited in rejected Claims 1-14.

Independent Claim 1 recites a "phase-shifting mask," comprising, in combination with other elements, that "the first trench having a first depth for phase-shifting light having a first wavelength and the second trench having a second depth deeper than the first depth for phase-shifting light having a second wavelength longer than the first wavelength."

Independent Claim 9 recites a "phase-shifting mask," comprising, in combination with other elements, that "the first plurality of trenches having a first depth for phase-shifting light having a first wavelength . . . the second trenches have a second depth deeper than the first depth for phase-shifting light having a second wavelength longer than the first wavelength."

Thus, each of Claims 1 and 9 require a single phase-shifting mask that includes a trench having a first depth for phase-shifting light having a first wavelength and a second trench having a second depth for phase-shifting light having a second wavelength. Such a phase-shifting mask represents an advance in the art that is not taught or suggested by any of the cited references, whether taken alone or in proper combination. For example, as stated at paragraph [0007] (with emphasis added):

As mentioned, various different wavelengths of light are used in different photolithographic processes. The optimal wavelength of light is based on many factors, such as the composition of the resist, the desired critical dimension (CD) of the integrated circuit, etc. Often times the optimal wavelength

of light must be determined by performing a lithography test with photolithographic equipment having different wavelengths. When a phase-shifting mask technique is utilized, two different phase-shifting masks must be fabricated, each mask having trenches 16 suitable for phase-shifting light of the desired wavelength. The fabrication of phase-shifting masks is costly. Further, comparison of the effect of the two printing processes at the different wavelengths is difficult. Differences in manufacturing biases or offsets between different phase-shifting masks further complicates comparison of the effects of the two printing processes.

None of the cited references, whether taken alone or in proper combination, teach or suggest the desirability or even the possibility of providing a single mask having trenches of different depths for phase-shifting light of two different wavelengths.

For example, the combination of Pierrat et al. and Tanaka et al. does not teach or suggest the subject matter recited in independent Claims 1 and 9. As described in the Applicants' previous Reply and Amendment, Pierrat et al. describes the use of a "phase shifting layer 22" that includes apertures of a single depth to obtain 180° phase shifts for two different wavelengths of light. Pierrat et al. describes such an arrangement at Column 2, lines 62-66 (with emphasis added):

In order to design a phase shifting mask whereby a 180° phase shift is obtained at a first wave length and a 180° phase shift is obtained at a second wave length, it is necessary to find a common depth for the phase shifting layer 22 which will produce the desired phase shifts.

The Examiner describes the citation of Pierrat et al. in the present Office Action as follows (with emphasis added):

This reference was cited by the examiner, because it shows what is required to perform exposure with two different wavelengths using the same depth for a phase shifting trench. The prior art obviously shows the relationship between exposure wavelength and depth of trench. And that a second trench with a different depth can be used to make a relative phase shift between the first and second trench, analogous to the shift from the surface and a first trench depth; and that a mask with a trench designed for phase shifting can be used with

two different wavelengths, if the wavelengths were selected appropriately.

The Applicants note with regard to the first underlined portion in the preceding paragraph that the Examiner has not shown that Pierrat et al. teaches or suggests the use of a single mask that includes trenches having different depths for phase shifting light having two different wavelengths. Instead, the Examiner properly notes that Pierrat et al. teaches only the use of “two different wavelengths using the same depth for a phase shifting trench.”

The Applicants also note that the second underlined portion of the above paragraph appears to describe what is disclosed by Tanaka et al. As described in the Applicants’ previous Reply and Amendment, Tanaka et al. relates to a mask intended for use with a single wavelength of light and discloses a “transparent transmitting substrate 11” in which “a portion of the substrate 11 corresponding to one opening pattern is etched to a depth D_1 and that of the substrate corresponding to another opening pattern is etched to a depth D_2 ” (Column 6, lines 16-20 and Figures 3A-3E).

While Tanaka et al. does disclose “opening patterns” etched to different depths (see Figure 3E), it does not teach or suggest the use of a single mask that includes trenches having different depths for phase shifting light having two different wavelengths.

The “phase-shifting mask” recited in independent Claims 1 and 9 would not have been obvious in view of Pierrat et al., alone or in any proper combination with Tanaka et al. under 35 U.S.C. § 103(a). Pierrat et al. alone or in any proper combination with Tanaka et al. does not disclose, teach or suggest a “phase-shifting mask” comprising, in combination with other elements, a “first trench (or plurality of trenches) having a first depth for phase-shifting light having a first wavelength” and a “second trench (or plurality of trenches) having a second depth deeper than the first depth for phase-shifting light having a second wavelength longer than the first wavelength.”

To transform the subject matter taught by Pierrat et al. and the subject matter taught by Tanaka et al. into a “phase-shifting mask” (as recited in Claims 1 and 9) would require further modification, and such modification is taught only by the Applicants’ own disclosure.

Accordingly, Claims 1 and 9 are patentable over the combination of Pierrat et al. and Tanaka et al.

The combination of Ito et al. and Tanaka et al. also does not teach or suggest the subject matter recited in independent Claims 1 and 9. As described in the Applicants' previous Reply and Amendment, Ito et al. relates to a "light transparent substrate" that includes a "phase shift pattern" (Column 4, lines 33-39).

Ito et al. does not teach or suggest the use of a single mask that includes trenches having different depths for phase shifting light having two different wavelengths. In contrast, Ito et al. states at Column 4, lines 44-50 (with emphasis added):

The substrate is characterized in that it is engraved at two kinds of depth, and the difference between respective engraved amounts approximately equals an engraved amount of the shallowly engraved part. Further, the substrate is characterized in that it has the phase difference of approximate 180 degree relative to the exposure light due to the difference between respective engraved amounts.

Thus, similar to Tanaka et al., the disclosure of Ito et al. seems to indicate that the mask described therein is intended for use with a single wavelength of light, and that phase-shifting occurs due to the difference between the depths of the engravings. There is no teaching or suggestion in Ito et al. that the substrate is "engraved at two kinds of depth" to allow one of the depths to shift a first wavelength of light and a second of the depths to shift a second, different wavelength of light. Further, there is no teaching or suggestion in Ito et al. that different depths may be used on a single mask to shift different wavelengths of light.

The "phase-shifting mask" recited in independent Claims 1 and 9 would not have been obvious in view of Ito et al., alone or in any proper combination with Tanaka et al. under 35 U.S.C. § 103(a). Ito et al. alone or in any proper combination with Tanaka et al. does not disclose, teach or suggest a "phase-shifting mask" comprising, in combination with other elements, a "first trench (or plurality of trenches) having a first depth for phase-shifting light having a first wavelength" and a "second trench (or plurality of trenches) having a second

depth deeper than the first depth for phase-shifting light having a second wavelength longer than the first wavelength.”

To transform the subject matter taught by Ito et al. and the subject matter taught by Tanaka et al. into a “phase-shifting mask” (as recited in Claims 1 and 9) would require further modification, and such modification is taught only by the Applicants’ own disclosure.

Accordingly, independent Claims 1 and 9 are patentable over the combination of Pierrat et al. and Tanaka et al. and over the combination of Ito et al. and Tanaka et al. Dependent Claims 2-8, which depend from independent Claim 1, and dependent Claims 10-14, which depend from independent Claim 9, are also patentable. See 35 U.S.C. § 112 ¶ 4.

The Applicants respectfully request reconsideration and withdrawal of the rejection of Claims 1-14 under 35 U.S.C. § 103(a).

The Applicants also note that various dependent claims are also allowable over the cited references for reasons in addition to those described above. For example, Claim 5 recites “the transparent material includes a first region of trenches including the first trench, the first region of trenches including a plurality of trenches having the first depth, wherein the transparent material includes a second region of trenches including the second trench, the second region of trenches including a plurality of trenches having the second depth.” Claim 6 depends from Claim 5 and recites “the first region comprises at least one-fourth of the surface area of one side of the transparent material and the second region comprises at least one-fourth of the surface area of the one side of the transparent material.” Claim 7 depends from Claim 5 and recites “the first region comprises approximately one-half of the surface area of one side of the transparent material and the second region comprises approximately one-half of the surface area of the one side of the transparent material.” The Applicants submit that the subject matter recited in Claims 5-7 is not taught or suggested by any of the cited references, whether alone or in proper combination. Reconsideration and withdrawal of the rejection of Claims 5-7 is therefore respectfully requested.

Claim 10 recites “the resist layer covers a first subset of the first trenches and leaves a second subset of the first trenches exposed, wherein the second subset of first trenches are

etched to form the second plurality of trenches." Claim 11 recites "the resist layer covers at least one-fourth of one side of the transparent material." Claim 12 recites "the resist layer covers approximately one-half of one side of the transparent material." The Applicants submit that the subject matter recited in Claims 10-12 is not taught or suggested by any of the cited references, whether alone or in proper combination. Reconsideration and withdrawal of the rejection of Claims 10-12 is therefore respectfully requested.

* * *

It is submitted that each outstanding objection and rejection to the Application has been overcome, and that the Application is in a condition for allowance. The Applicants therefore request consideration and allowance of all pending Claims 1-22.

The Examiner is invited to contact the undersigned by telephone if it is felt that a telephone interview would advance the prosecution of the present application.

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 06-1447. Should no proper payment be enclosed herewith, as by a check being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 06-1447. If any extensions of time are needed for timely acceptance of papers submitted herewith, Applicants hereby petition for such extension under 37 C.F.R. §1.136 and authorizes payment of any such extensions fees to Deposit Account No. 06-1447.

Respectfully submitted,

Date

3/19/2004

By



FOLEY & LARDNER LLP

Customer Number: 26371

Telephone: (414) 297-5564

Facsimile: (414) 297-4900

Marcus W. Sprow

Attorney for Applicant

Registration No. 48,580